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09/854,206	05/11/2001	David S. Pecora	00-0737.00/US	7849

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EXAMINER

TRAN, BINH X

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 07/08/2003

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Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/854,206

Applicant(s)

PECORA, DAVID S.

Examiner

Binh X Tran

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1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 09 May 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 17 and 18 is/are allowed.
- 6) ☒ Claim(s) 1-16 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

## DETAILED ACTION

### *Claim Rejections - 35 USC § 112*

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 2, 10 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claims 2, 10, the limitation "said oxygen and said one of CHF<sub>3</sub> and CH<sub>2</sub>F<sub>2</sub> into an etch chamber at a ratio of about 3:1 during said etching" is contradict and conflict with the previous claim 1 or claim 9. In claims 1 and 9, the applicants already claim "that flow rates provide an etch having a proportions of greater than about 75% of said oxygen and less than about 25% of said one of CHF<sub>3</sub> and CH<sub>2</sub>F<sub>2</sub>". The examiner interprets that the percentage of oxygen must be greater than about 75% and the percentage one of CHF<sub>3</sub> and CH<sub>2</sub>F<sub>2</sub> must be less than 25%. Base on this number, any one skill in the art would be able to calculate that the ratio of oxygen and said one of CHF<sub>3</sub> and CH<sub>2</sub>F<sub>2</sub> must be greater than 3:1. This ratio cannot be about 3:1.

### *Claim Rejections - 35 USC § 103*

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-6, 8-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsuo et al. (US 5,994,227) in view of Yatsuda et al. (EP 0945896 A1).

Matsuo discloses a method for etching a silicon nitride layer comprising:

etching the silicon nitride layer with an etching consisting essentially of oxygen and  $\text{CH}_2\text{F}_2$  (See Fig 3-5, col. 3 lines 5-8, col. 3 lines 25-50).

Claim 1 differs from Matsuo by the specific flow rate, pressure and the specific percentage of oxygen and at least one of  $\text{CHF}_3$  and  $\text{CH}_2\text{F}_2$ . However, Matsuo discloses that the mixture ratio of oxygen and  $\text{CH}_2\text{F}_2$  is a result effective variable (Fig 6). Since mixture ratio is the result effective variable, the flow rate of individual oxygen and  $\text{CH}_2\text{F}_2$  must be a result effective variable because the mixture ratio depends on flow rate of oxygen divided and the flow rate of  $\text{CH}_2\text{F}_2$ .

In a silicon nitride etching process, Yatsuda discloses that pressure and flow rate is the result effective variable. Yatsuda discloses that the pressure is about 50-100 mtorr (within applicant's range of 10-60 mtorr). Yatsuda also discloses the flow rate of  $\text{CH}_2\text{F}_2$  is about 20-60 sccm (within applicant's range of 5-25 sccm) and the flow rate of oxygen is about 20-100 sccm (page 5, within applicant's range of 20-80 sccm). The result effective variables are commonly determined by routine experiment. The process of conducting routine optimization experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment to obtain optimal value as an expected result.

Yatsuda discloses the silicon nitride was etched using  $\text{CH}_2\text{F}_2/\text{O}_2$ . Yatsuda further discloses the ratio of  $\text{CH}_2\text{F}_2/\text{O}_2$  ranges from 0.2 to 0.6 (Fig 5). Since Yatsuda clearly discloses the specific ratio range of  $\text{CH}_2\text{F}_2/\text{O}_2$ . Any person having ordinary skill in the art, would be able to choose any ratio within the suggested range of Yatsuda. For example, if one chooses the ratio of  $\text{CH}_2\text{F}_2/\text{O}_2$  is less than  $1/3$  (less than 0.3333), one skill in the art can convert it into less than 25% oxygen and greater than 75% of  $\text{CH}_2\text{F}_2$ .

Respect to claim 2, Matsuo does not explicitly disclose the ratio of oxygen to  $\text{CH}_2\text{F}_2$  is about 3:1. Yatsuda discloses the silicon nitride was etched using  $\text{CH}_2\text{F}_2/\text{O}_2$ . Yatsuda further discloses the ratio of  $\text{CH}_2\text{F}_2/\text{O}_2$  is range from 0.2 to 0.6 (Fig 5). Since Yatsuda clearly disclose the specific ratio range of  $\text{CH}_2\text{F}_2/\text{O}_2$ . Any person ordinary skill in the art, would be able to choose any ratio within the suggested range of Yatsuda. For example, if one chooses the ratio of  $\text{CH}_2\text{F}_2/\text{O}_2$  is less or equal than  $1/3$ , one skill in the art would be able to calculate the ratio of  $\text{O}_2$  to  $\text{CH}_2\text{F}_2$  is greater or equal to about 3:1

Claims 3-6 differ from the cited prior art by the specific value of power, flow rate of  $\text{CH}_2\text{F}_2$  and oxygen. Yatsuda discloses that power is set to about 500 watts (page 6 line 6, read on applicant's range of 300-600 Watts). The flow rate and pressure are result effective variable. The result effective variables are commonly determined by routine experiment. The process of conducting routine optimization experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment to obtain optimal value as an expected result.

Respect to claim 8-9 Matsuo discloses:

providing a semiconductor wafer assembly comprising a semiconductor substrate (30) and a layer a silicon dioxide overlying the wafer (Fig 1, col. 2 lines 57-67);

forming a silicon nitride (5) over the semiconductor substrate (30) and the silicon dioxide layer;

placing the semiconductor wafer assembly into an etch chamber;

etching the silicon nitride layer after the resist mask is removed in previous step (read on "in the absence of a photoresist layer) with an etching consisting essentially of oxygen and  $\text{CH}_2\text{F}_2$  (See Fig 3-5, col. 3 lines 5-8, col. 3 lines 25-50) to expose the semiconductor substrate and the silicon dioxide layer (aka silicon oxide layer, See Fig 4 and/or Fig 9) .

The limitation regarding the specific percentage of oxygen and  $\text{CH}_2\text{F}_2$  has been discussed in previous paragraphs. Matsuo does not disclose the semiconductor substrate is silicon. Yatsuda discloses that the semiconductor substrate is silicon (2).

Claims 8-9 differ from the cited prior by the specific value of pressure. This limitation has been discussed in previous paragraph. The limitation of dependent claims 10-15 is identical with the limitation of dependent claims 2-6 which already discussed in previous paragraph.

5. Claims 7, 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsuo and Yatsuda in view of Campell.

Claims 7 and 16 differ from the cited prior art by the specific value of power, and pressure. The limitation regarding the specific pressure as a result effective variable has been discussed in previous paragraphs. Campbell discloses that power is the

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result effective variable during the etching process by varying the power from 0 Watt to 3 KW (Fig 11, 300-400 Watts). The result effective variables are commonly determined by routine experiment. The process of conducting routine optimization experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment to obtain optimal value as an expected result.

#### ***Allowable Subject Matter***

6. Claims 17-18 are allowed.
7. The following is a statement of reasons for the indication of allowable subject matter: The cited prior arts fail to disclose or suggest either the step of anisotropic etching the silicon nitride layer over the top surface of the first and the second integrated circuit structures and over the horizontal base surface with an etchant consisting essentially of oxygen at the flow rate of 20-80 sccm and  $\text{CHF}_3$  at the flow rate of 5-25 sccm having oxygen to  $\text{CHF}_3$  ratio of about 3:1 and vertical to horizontal etch rate about 4:1; or anisotropic etching the silicon nitride layer over the top surface of the first and the second integrated circuit structures and over the horizontal base surface with an etchant consisting essentially of oxygen at the flow rate of 20-80 sccm and  $\text{CH}_2\text{F}_2$  at the flow rate of 5-25 sccm having oxygen to  $\text{CH}_2\text{F}_2$  ratio of about 3:1 and vertical to horizontal etch rate about 4:1 in conjunction with other limitation in the claims.

#### ***Response to Arguments***

8. Applicant's arguments filed 5-9-2003 have been fully considered but they are not persuasive.

In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, Yatsuda clearly teaches to adjust the result effective variables such as flow rate, etchant component ratio, pressure in order to achieve optimal result.

The applicants further argue that the combination of Matsuo and Yasuda is not possible because it taught away from Matsuo by using the percentage outside of 25%-40% of Matsuo preferred ranges. The examiner disagrees. Teaching a way or another way is not a teaching away. Teaching another way refers to the fact that a reference teaches a preferred or an alternative way to claimed way of accomplishing something.



**Conclusion**

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.


10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Binh X Tran whose telephone number is (703) 308-1867. The examiner can normally be reached on Monday-Thursday and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin L Utech can be reached on (703) 308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

Binh X. Tran  
July 1, 2003

  
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